

### Agenda

- Recap of Meeting 2
- Draft Benthic TMDLs
  - Bull Run
  - Popes Head Creek
  - South Run
- Draft Bacteria TMDLs
  - Occoquan River
     Watershed
- Next Steps



## Recap from Meeting 2

- Presented and discussed the stressor analysis methodology and reports for the Benthic TMDLs
- Presented and discussed the source assessment for the Bacteria TMDLS

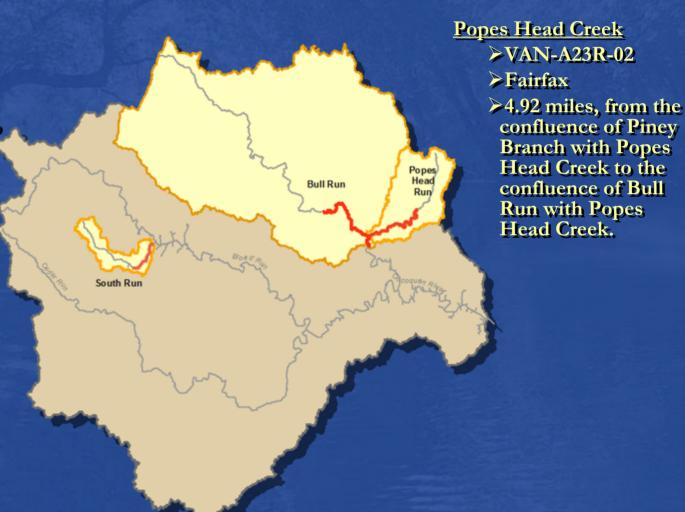
# Three Segments Listed for Benthic Impairment

#### **Bull Run**

- **►VAN-A23R-01**
- Fairfax, Prince William
- >4.8 miles, from the confluence of Cub Run with Bull Run to the confluence of Popes Head Creek with Bull Run

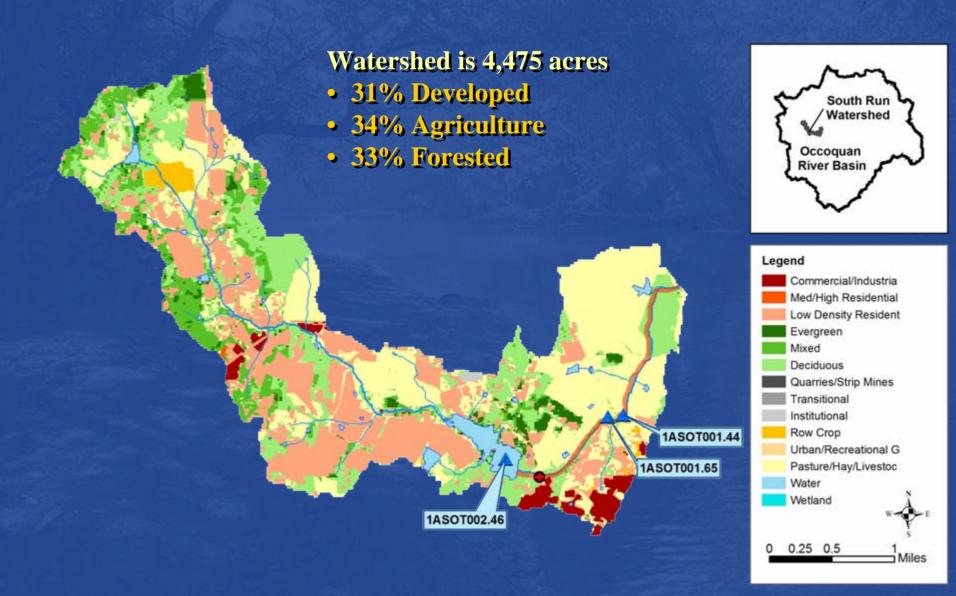
#### South Run

- > VAN-A19R-04
- Fauquier, Prince William
- > 2.34 miles from Lake
  Brittle to the
  confluence of South
  Run with the
  inundated waters of
  Lake Manassas



### South Run

### Land Use: South Run Watershed



# South Run Stressor Identification

### Data Used in Stressor Identification

Agency/Group	Number of Sites	Number of Samples	Date Range Used	Data Type
Virginia Department of Environmental Quality	3	125	1994 - 2005	Ambient, Biological, Habitat
Occoquan Watershed Monitoring Lab	3	1015	January 1994 - December 2004	Ambient, Flow
Discharge monitoring reports	1	77	February 1999 - June 2005	Discharge Monitoring

### **Stressor Analysis Conclusion**

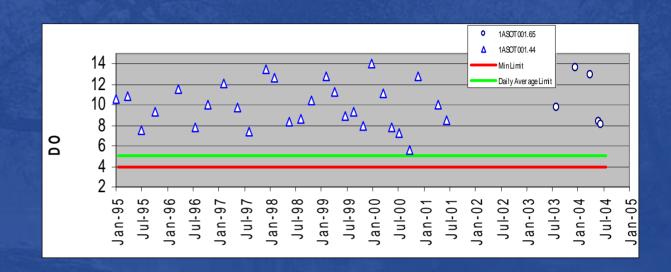
- Most Probable Stressor: Organic and nutrient enrichment
- Daily DO swings indicative of high levels of biotic production and the presence of eutrophication processes related to excessive nutrient loads were observed.
- This suggestion is supported by notes indicating the presence of excessive filamentous algae, which is commonly observed in streams with a high nutrient content (often from high nutrient content fertilizers).
- Organic enrichment in South Run is confirmed by a lower EPT taxa count and consistently high MFBI scores, which are indicative of a relatively tolerant community and of organic enrichment.

### **Parameter** Non-Stressors Dissolved Oxygen Temperature and pH Metals **Organics Possible Stressors Toxicity Most Probable** stressors Organic and Nutrient Enrichment

# South Run End point/ Numeric Target

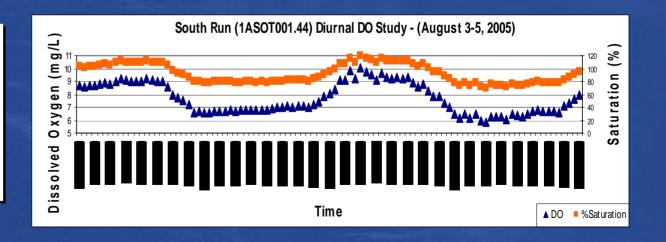
### Dissolved Oxygen in South Run

Ambient DO shows no exceedances of the minimum WQ Standard



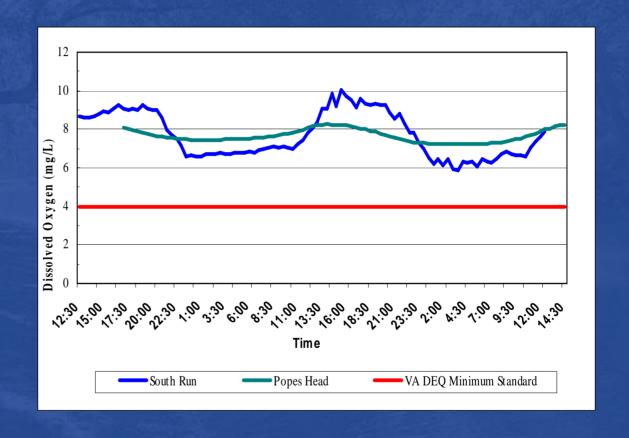
### **South Run Diurnal DO** indicates:

- •A very productive system
- •Daily DO range of 4 mg/L
- •Super-saturation of DO



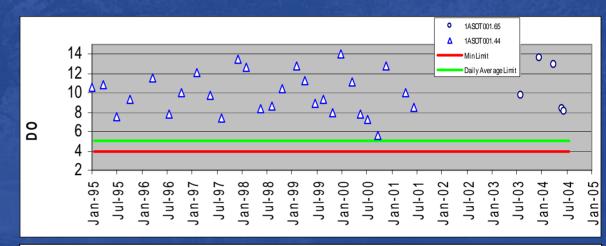
# Diurnal Dissolved Oxygen in Popes Head and South Run - August 2-3 2004

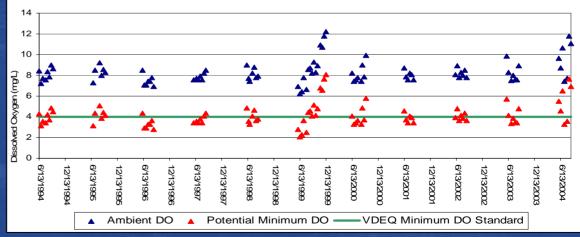
Diurnal DO variations in Popes Head show an adequate variation of 1 mg/L



### Ambient Dissolved Oxygen and Potential Minimum DO in South Run (Summer Months)

- •Applying the diurnal fluctuations of 4 mg/L to the summer months ambient DO data indicates:
- DO fluctuations are a potential causing the potential DO to drop below the minimum standard
- The causes of these DO fluctuations is attributed to excessive nutrient (N, P) loadings



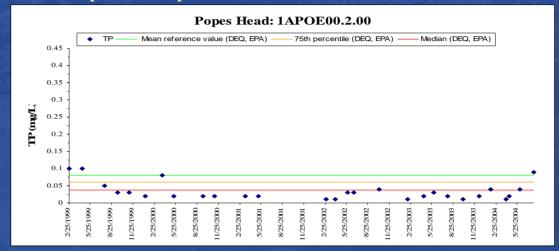


### **Nutrient TMDL End-Point**

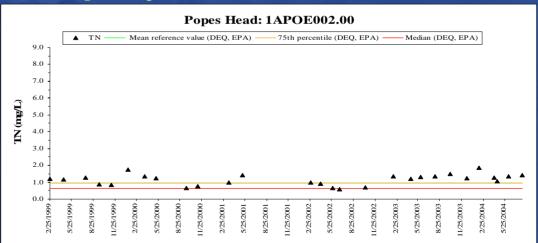
#### No standard for nutrients

- Use a reference watershed approach
- Popes Head is proposed as a reference where TN & TP are within VADEQ/EPA nutrient reference values

#### Total Phosphorus in Popes Head Creek between 1999 and 2005



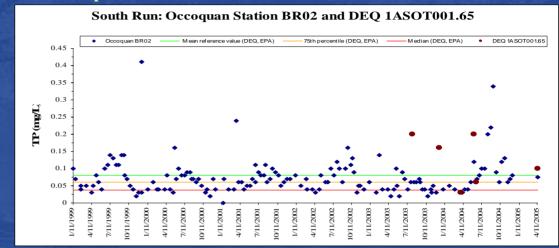
#### Total Nitrogen in Popes Head Creek between 1999 and 2005



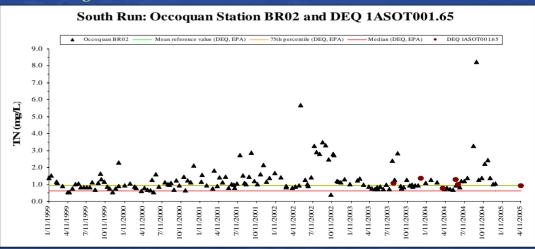
# Ambient Nutrient Observations in South Run

South Run ambient monitoring data indicates that nutrient concentrations frequently exceed the VADEQ/EPA reference values for phosphorus and nitrogen.

#### Total Phosphorus in South Run Creek between 1999 and 2005



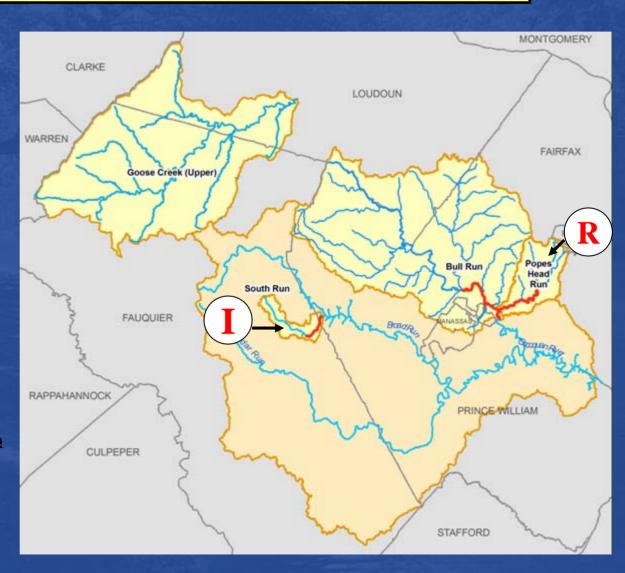
#### Total Nitrogen in South Run Creek between 1999 and 2005



### Reference Watershed Selection

### Popes Head Creek Watershed

- Not impaired for nutrients
  - Has acceptable DO swings
  - Relatively low Phosphorus and Nitrogen concentrations
- No point sources present
- In the same ecoregion as South Run



# South Run Nutrient Loads

### Nutrient Sources

- Nutrients can be delivered to the stream from point sources located in the watershed and it can be carried in the form of nonpoint source runoff from agricultural as well as urban land uses.
- Nutrient enrichment adversely impacts the benthic macroinvertebrate community through loss of habitat and degradation of water quality.

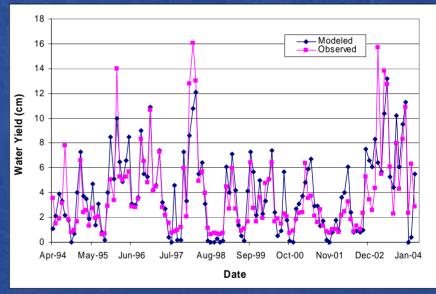
## Source Loading Estimates

- 1. Identify potential sources
- 2. Calculate the point source, nonpoint source (land based) loads
- 3. The sum of all the individual sources is the total load
- 4. Load Calculation Process:
  - 1. Reference Watershed loading
  - 2. Adjust the reference watershed load for size
  - 3. South Run Loading

### Modeling Approach

# Pollutant Load estimate needs to consider three components

- Land based load
  - GWLF Model
- > Point Sources
  - Permitted Loads
- Lake Brittle Load



Flow Used for Model: Bull Run

### Lake Brittle Contribution

- The Department of Game and Inland Fisheries (DGIF) conducted a nutrient study on Lake Brittle between October 1988 and September 1989. The study focused at the inlet and outlet of Lake Brittle (DGIF, 1989).
- ➤ DGIF concluded that "no increase in total phosphorus" was determined between the inlet and outlet of Lake Brittle. The phosphorus concentration was 0.1 mg/L for both the inlet and outlet.
- In addition, the water quality study concluded that Lake Brittle acts "as a phosphorus sink". Therefore, Lake Brittle does not have a significant impact on the total phosphorus concentration in South Run.

# South Run Nutrient Loading - Existing Condition

		T	Phosphorus otal Load (tons/y	r)	Nitrogen Total Load (tons/yr)			
Source	Land Use Type	Reference Watershed	Area-Adjusted Reference Watershed	Impaired Watershed	Reference Watershed	Area- Adjusted Reference Watershed	Impaired Watershed	
	Transitional	0.01	0.00	0.00	0.03	0.01	0.00	
	Quarries/Strip Mine	0.00	0.00	0.00	0.00	0.00	0.00	
	Deciduous Forest	0.02	0.01	0.00	0.19	0.07	0.06	
Cont. Live	Evergreen Forest	0.00	0.00	0.00	0.02	0.01	0.01	
	Mixed Forest	0.00	0.00	0.00	0.02	0.01	0.02	
Land Sources	Pasture/Hay/Livestock	0.06	0.02	0.209	1.05	0.37	4.11	
Land Sources	Row Crop	0.01	0.00	0.044	0.03	0.01	0.17	
	Low intensity residential	0.39	0.14	0.099	7.82	2.81	1.94	
	Commercial/Industrial	0.11	0.03	0.044	1.06	0.37	0.45	
	Medium/High Residential	0.62	0.22	0.00	3.50	1.26	0.01	
	Institutional	0.08	0.02	0.00	0.30	0.11	0.01	
	Urban/Recreational Grass	0.01	0.00	0.00	0.14	0.06	0.00	
Groundwater		0.24	0.09	0.088	6.43	2.32	2.37	
Septic System		0.01	0.01	0.011	1.65	1.65	1.60	
Point Sources	Point Sources -		0.00	0.173	0.00	0.00	2.10	
	Total	1.54	0.56	0.668	22.23	9.05	12.83	

### Endpoint for Nitrogen?

- > On average, N/P ratio is 18
  - Range between 11.6 and 25.5 between 1999 and 2004 based on Occoquan Lab Station BR02 data)
- Since N/P ratio is > 7.2, system is phosphorus limited
- Phosphorus controls the level of production in South Run
- Therefore, reduction of phosphorus will improve the water quality conditions and the benthic community in South Run

# South Run Total Maximum Daily Load (TMDL)

### **TP Load-Reduction Scenarios**

Since there is a plan to relocate the Vint Hill Farm discharge outfall, the following proposed TP load allocation scenarios will consider phosphorous load reduction from the point and nonpoint sources.

### Scenario 1: Existing Condition:

- NPS: concentration and flow are based on simulation results from GWLF.
- ➤ Point Source: Discharge effluent concentration is based on average DMR data and current design flow.

#### ■ Scenario 2:

- NPS: concentration and flow are based on simulation results from GWLF.
- Point Source: Discharge effluent concentration at 0.3 mg/L and current design flow.

#### Scenario 3:

- NPS: concentration and flow are based on simulation results from GWLF.
- Point Source: Discharger outfall is relocated.

#### Scenario 4: TMDL

- NPS: concentration and flow are based on simulation results from GWLF.
- Point Source: Discharger outfall is relocated. However, some of the load is reserved for potential future growth.

# Comparison of Total Phosphorous Load to TMDL End-Point

	Point Source (ton/year)					TMDL End-point (ton/year)	Difference (%)
1	0.175	0.496	0.671	0.5058	+ 32.7		
2	0.113	0.393	0.609	0.5058	+ 20.4		
3		0.496	0.496	0.5058	- 2.0		
4	0.010	0.496	0.506	0.5058	0		

# Total Phosphorous Load Reductions

	Load (ton/year)		Total Load	Exceedances
Scenario	PS	NPS	(ton/year)	(%)
1	0.175	0.496	0.671	32.7
2	0.113	0.393	0.506	0
3	0.000	0.496	0.496	0

Required Phosphorous Load Reduction to meet the TMDL Endpoint (%)							
PS NPS							
0	0						
35.43	20.81						
100	0						

	TP Reduction (%)		Load (t	on/year)	Total Load <sup>1</sup> (ton/year)	Exceedances (%)
Scenario	PS	NPS	PS	NPS		(/•/
4 TMDL	2.0 % of LA	0.00	0.010	0.496	0.506	0.00

# Instream Total Phosphorous Concentration Under TMDL Scenarios

Scenario	Nonpoint	: Source <sup>1</sup>	Point	Source	Instream P (mg/l)	Tributaı		ary Strategy			
						S	Shenandoah		Ra	ppahanno	ock
	mg/L	cfs	mg/L	$MGD^2$	mg/L	Min	Mean	Max	Min	Mean	Max
13	0.053	9.58	1.59	0.072	0.070						
2	0.053	9.58	0.30	0.247	0.062	0.054	0.126	0.219	0.055	0.122	0.270
3	0.053	9.58		-	0.053						

<sup>&</sup>lt;sup>1</sup> Based on GWLF simulation results for South Run

Source: DEQ Freshwater Nutrient Criteria – Analysis of Downstream Effects, 2005.

<sup>&</sup>lt;sup>2</sup> Million Gallons per day

<sup>&</sup>lt;sup>3</sup> Existing condition: Average effluent concentration and discharge in 2004

## South Run TMDL

TMDL	Load Allocation (tons/yr)	Wasteload Allocation	Margin of Safety (10%)	
(tons/yr)		(tons/yr)	(tons/yr)	
0.562	0.496	0.010	0.056	

# South Run TMDL Summary

- ➤ A TMDL allocation plan to meet and achieve the full support of aquatic life in South Run requires the following reductions in the Total Phosphorous loads:
  - Relocation of the point source discharge outfall out of the South Run watershed while allocating 2.0% of the nonpoint source load to WLA to allow for potential future growth.

# Next Steps

- Draft TMDL Reports
- Respond to public comments
- Final TMDL Reports
- Submit TMDL Reports to EPA

### Local TMDL Contacts



### Department of Environmental Quality

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